NEC-1-04 (AZ Only)

Revision to NEC Article 250.118

250.118. Types of Equipment Grounding Conductors
The equipment grounding conductor run with or enclosing the circuit conductors shall be one or more or a combination of the following:

1. A copper, aluminum, or copper-clad aluminum conductor. This conductor shall be solid or stranded; insulated, covered, or bare; and in the form of a wire or a busbar of any shape.
2. Threaded Rigid metal conduit and fittings.
3. Threaded Intermediate metal conduit and fittings.
4. ~~Electrical metallic tubing.~~
5. ~~Flexible metal conduit with an individual equipment grounding conductor and where both the conduit and fittings are listed for grounding.~~
6. ~~Listed flexible metal conduit that is not listed for grounding and meeting all the following conditions.~~
   a. ~~The conduit is terminated in fittings listed for grounding.~~
   b. ~~The circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.~~
   c. ~~The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground return path does not exceed 6 ft (1.83 m).~~
   d. ~~The conduit is not installed for flexibility.~~
7. ~~Listed liquidight flexible metal conduit meeting all the following conditions.~~
   a. ~~The conduit is terminated in fittings listed for grounding.~~
   b. ~~For trade sizes 3/8 in. through ½ in., the circuit conductors contained in the conduit are protected by overcurrent devices rated at 20 amperes or less.~~
   c. ~~For trade sizes ¾ in. through 1¼ in., the circuit conductors contained in the conduit are protected by overcurrent devices rated not more than 60 amperes and there is no flexible metal conduit, flexible metallic tubing, or liquidtight flexible metal conduit in trade sizes 3/8 in. or ½ in. in the grounding path.~~
   d. ~~The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground return path does not exceed 6 ft (1.83 m).~~
   e. ~~The conduit is not installed for flexibility.~~
8. ~~Flexible metallic tubing~~ where the tubing is terminated in fittings listed for grounding ~~and meeting all the following conditions.~~
   a. ~~The circuit conductors contained in the tubing are protected by overcurrent devices rated at 20 amperes or less.~~
   b. ~~The combined length of flexible metal conduit and flexible metallic tubing and liquidtight flexible metal conduit in the same ground return path does not exceed 6 ft (1.83 m).~~
9. Armor of Type AC cable as provided in Section 333-21.
10. The copper sheath of mineral-insulated, metal-sheathed cable.
11. The metallic sheath or the combined metallic sheath and grounding conductors of Type MC cable with an individual equipment grounding conductor.
12. Cable trays as permitted in Sections 318-3(c) and 318-7.
13. Cablebus framework as permitted in Section 365-2(a).
14. Other electrically continuous metal raceways listed for grounding.

Reason: For reasons of extreme temperature fluctuations found throughout the State causing expansion and contraction of the metal conduit separating the non-threaded type fittings. This will eliminate the equipment grounding connection and therefore preventing a low impedance path to clear a ground fault. This situation would either set up a shock hazard or a fire hazard.

Additional Supporting Information:

SUBJECT: Technician Electrocuted While Performing
Maintenance on a Walk-In Cooler in Virginia
CAUSE: Electrocution

SUMMARY: On August 20, 1991, a 33-year-old male employed as a heating, ventilating, air-conditioning, and refrigeration (HVACR) technician, was electrocuted while performing refrigeration maintenance on a walk-in cooler at a restaurant.

The flexible metal conduit housing the power conductors to the refrigeration unit (RU) of the cooler had been designed to serve as the mechanical ground. The insulation on one of the three power conductors in the flexible conduit was damaged and allowed electrical arcing to a conduit connector on the RU starter box. The conduit connection from the RU to the RU starter box was loose, and effectively disconnected the mechanical ground from the RU. As the victim was servicing the RU, the temperature in the walk-in cooler must have caused the thermostat to close the starter, energizing the surfaces of the RU, and fatally shocking the technician when he touched it. NIOSH investigators concluded that to prevent similar occurrences, employers should:

o require that all electrical equipment be de-energized before any electrical repairs are performed

o provide a mechanical grounding conductor as part of the power feed to an appliance whenever possible

o provide ground-fault protection as part of the power feed to an appliance whenever possible

o provide employees with education and training in the recognition, avoidance, and prevention of unsafe work conditions.

NEC-2-04 (AZ Only)

Revision to IRC Section E3808.8

E3808.8 Types of equipment grounding conductors. The equipment grounding conductor run with of enclosing the circuit conductors shall be one or more or a combination of the following:

(No changes to Section with the exception of the following deletions):

2. Threaded rigid metal conduit and fittings.
3. Threaded intermediate metal conduit and fittings.
4. ~~Electrical metallic tubing.~~
5. ~~Flexible metal conduit, where both the conduit and fittings are listed for grounding.~~

Reason: For reasons of temperature fluctuations found throughout the State causing expansion and contraction of the metal conduit. See amended Section 250.118 coordination of NEC to IRC.

NEC-3-04 (Directive)

Revision NEC Article 210.8 (a) & (b)

210.8. Ground-Fault Circuit-Interrupter Protection for Personnel
FPN: See Section 215.9 for ground-fault circuit-interrupter protection for personnel on feeders.

(No changes to Article with the exception of the following revisions):

(A) Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) through (8) shall have ground-fault circuit-interrupter protection for personnel.

(7) ~~Wet bar sinks. Where the receptacles are installed to serve the countertop surfaces and are located within 1.8 m (6 ft) of the outside edge of the wet bar sink.~~ Convenience receptacles located within 1.8 m (6 ft) of any sink, wash basin, tub, or shower.

(B) Other than Dwelling Units. All 125-volt, single-phase, 15- and 20-ampere receptacles installed in the locations specified in (1) ~~, (2), and (3)~~ through (5) shall have ground-fault circuit-interrupter protection for personnel.

(4) Convenience receptacles located within 1.8 m (6 ft) of any sink, wash basin, tub, or shower.

(5) Outdoors.

Reason: Possibility of personnel coming in contact with electrical appliances that are in contact with wet conditions creating the possibility for electrocution.

Additional supporting information:

These are NIOSH reports:
FACE: 84WV17

SUBJECT: Electrocution in a Fast Food Restaurant
CAUSE: Electrocution

SUMMARY: On June 30, 1984, at about 1:05 A.M., an 18-year-old male employee with 15 months experience at a fast food restaurant was electrocuted while plugging a portable electric toaster into a 110 volt/20 amp receptacle.

A the time of the incident, employees had closed the restaurant and damp-mopped the floors. About 5 to 10 minutes after mopping, the victim was in the process of plugging the toaster into a floor outlet when he received the shock. The assistant manager and other employees were elsewhere and did not see the victim. The assistant manager heard a scream and investigated. The assistant manager and the other workers then found the victim with one hand on the plug, the other hand wrapped around the receptacle box, and with his face on top of the outlet. An employee tried to take the victim's pulse but was shocked. The assistant manager went to the breaker box to open the breaker for that circuit, but could not find the specific breaker. He then called the emergency squad, returned to the box and found the right breaker. The victim had by then been in contact with the current for 3 to 8 minutes. An employee checked the victim's pulse and found a very rapid radial pulse. The employee and assistant manager then unlocked the front door and placed another call to the rescue squad. The employee checked the victim's pulse again and found none. An employee living nearby arrived and started CPR, which was continued by the rescue squad upon its arrival. CPR was administered for 1.5 hours. The victim was DOA at the local hospital. Two different electricians later evaluated the circuit and found no serious problems. It is surmised that while holding the plug, the victim's right hand slipped forward to make contact through the index finger to the energized prong. With his left hand holding the spring-loaded cover open, a current path through the arms, chest, and heart would be established from the prong to the ground. After the accident the employer required employees to open circuits at the breaker box before plugging and unplugging equipment. This strategy is not recommended because it relies on positive human action and places excessive wear on the breakers. Recommendations:

o Ground Fault Circuit Interrupter Breakers (GFCI's) would have interrupted the circuit before sufficient current had passed to cause physical damage to the body. They are recommended as the best solution.

o The location and design of the receptacle, the design of the plug, and the recent mopping contributed to the incident.

o CPR should be initiated when an unstable pulse is detected, rather than later when no pulse is found.

FACE: 86NC43

SUBJECT: 25-Year-Old Restaurant Manager |
Electrocuted in North Carolina
CAUSE: Electrocution

SUMMARY: On August 3, 1986, a 25-year-old male restaurant manager was cleaning the floor of the kitchen when he came in contact with a refrigerator that had a ground fault. The manager was electrocuted.

The restaurant was closed and the manager's wife and 2-year-old daughter were in the dining area waiting for him to finish. The victim, who was wearing tennis shoes, put soap and water on the floor. He slipped and grabbed the handle of a commercial refrigerator. The refrigerator had a ground fault and was not grounded -- the cord did not have a ground prong. The ground fault was apparently caused by excessive wear on the insulation of the conductors (wires) supplying power to the compressor. The conductors were exposed at a cut-out hole in the case of the refrigerator, were not protected from abrasion, and were not protected by strain relief. The victim's wife heard a noise in the kitchen. She successfully pulled the victim from the refrigerator into the dining area, though she was shocked in the process. She summoned help and began CPR, but to no avail. Recommendations:

o All electrical equipment (such a refrigerators) should be designed and maintained to comply with all applicable requirements of the National Electrical Code. In this case the defects in the refrigerator apparently developed over time and were not recognized as hazardous. The refrigerator was bought used and the owner had no owner's manual.

o Restaurant owners and managers should be encouraged to conduct formalized safety training for all restaurant employees.

o All electrical receptacles (outlets) in restaurant kitchens should be protected by ground fault circuit interrupters. See NIOSH ALERT (85-104).

NEC-4-04 (Directive)

Revision to IRC Section E3802.7

E3807.2 ~~Bar sink receptacles~~ Sink, wash basin, tub, or shower receptacles. All 125-volt, single-phase,15- and 20-ampere convenience receptacles that ~~serve a countertop surface, and~~ are located within 6 feet (1829 mm) of the outside edge of ~~a wet bar~~ any sink , wash basin, tub, or shower shall have ground-fault circuit-interrupter protection for personnel.

Reason: Possibility of personnel coming in contact with appliances that are in contact with wet conditions creating the possibility for electrocution. See amended Section 210.8, this will coordinate the NEC and IRC.

NEC-5-04 (AZ Only)

Revision to NEC Article 310.15 (b)(6) & NEC Table 310.15 (b)(6)

(6) 120/240-Volt and 120/208-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders. For dwelling units, conductors, as listed in Table 310-15(b)(6), shall be permitted as 120/240-volt and 120/208 volt, 3-wire, single-phase-service-entrance conductors, service lateral conductors, and feeder conductors that serve as the main power feeder to a dwelling unit and are installed in raceway or cable with or without an equipment grounding conductor. For application of this section, the main power feeder shall be the feeder(s) between the main disconnect and the lighting and appliance branch-circuit panelboard(s). The feeder conductors to a dwelling unit shall not be required to be larger than their service-entrance conductors. The grounded conductor shall be permitted to be smaller than the ungrounded conductors, provided the requirements of Sections 215-2, 220-22, and 230-42 are met.

Table 310-15(b)(6). Conductor Types and Sizes for 120/240-Volt and 120/208-Volt, 3-Wire, Single-Phase Dwelling Services and Feeders.

Conductor (AWG or kcmil)

Copper	Aluminum or Copper-Clad Aluminum	~~Service or Feeder Rating (Ampere)~~	Service or Feeder Rating (Amperes) ≤ 30°C (86°F)	Service or Feeder Rating (Amperes) > 30°C 86°F)
4	2	~~100~~	100	
3	1	~~110~~	110	
2	1/0	~~125~~	125	100
1	2/0	~~150~~	150	125
1/0	3/0	~~175~~	175	150
2/0	4/0	~~200~~	200	175
3/0	250	~~225~~	225	200
4/0	300	~~250~~	250	225
250	350	~~300~~	300	250
350	500	~~350~~	350	300
400	600	~~400~~	400	350
500	750			400

FPN: for single-phase panels feed from a 3-phase system, the grounded conductor cannot be reduced in size for a 120/208-volt system, see 220.22

Reason: Clarification to include 120/208-volt Single-Phase systems and ambient correction to Table for temperature conditions found throughout the State. These correction factors are already in the NEC at the bottom of Table 310.16.

NEC-6-04 (AZ Only)

Add New Article to NEC:

230.63. Location. All service equipment rated 1000 amperes or more located inside a building shall be enclosed within a room or space separated from the rest of the building by not less than one-hour fire-resistive occupancy separation or fire barrier installed in compliance with the building code.

Reason: For coordination with Utility company requirements. This will be proactive to the customer, catching this at plan review will prevent the customer from being refused Utility Service at final if they have Service Equipment 1000 amperes and larger inside of the building and not enclosed in a one-hour room.

NEC-7-04 (Directive)

Revision to NEC Articles 334.10 & 334.12

334.10 Uses Permitted. Type NM, Type NMC, and Type NMS cables shall be permitted to be used in the following:

1. One- and two-family dwellings, multifamily dwellings, and other residential accessory structures
   (b) 2. ~~Multifamily dwellings permitted to be Types III, IV, And V construction except as prohibited in 334.~~

(Items 3 & 4 to remain the same)

334.12. Uses Not Permitted.
(A) Types NM, NMC, and NMS. Types NM, NMC, and NMS cables shall not be used as follows:

(Item 1 remains the same)

~~2. As service-entrance cable~~
~~3. In commercial garages having hazardous (classified) locations as provided in Section 511-3~~
~~4. In theaters and similar locations, except as provided in Article 518.4.~~
~~5. In motion picture studios~~
~~6. In storage battery rooms~~
~~7. In hoistways or on elevators or escalators.~~
~~8. Embedded in poured cement, concrete, or aggregate~~
9. ~~In hazardous (classified) locations, except as permitted in the following:~~
   ~~a. 501.4(B) Exception~~
   ~~b. 502.4(B) Exception No.1~~
   ~~c. 504.20~~

(Item 10 to remain the same)

Reason: For clarification; Items deleted seem to identify occupancies other than Dwelling type structures would not be allowed to use this type of wiring method. This will clarify that this type of wiring method shall only be used in Dwelling type occupancies.

NEC-8-04 (Directive)

Revision to NEC Articles 358.10 & 358.12

358.10 Uses Permitted

(B) Corrosion Protection. Ferrous or nonferrous EMT, elbows, couplings, and fittings shall be permitted to be installed in concrete ~~,~~ that is not in direct contact with the earth ~~,~~ or in areas subject to severe corrosive influences where protected by corrosion protection and judged suitable for the condition.

358.12 Uses Not Permitted. EMT shall not be used under the following conditions:

(Items 1 through 6 to remain the same)

(7) On or below grade.

Reason: For clarification, EMT fittings are not approved to be installed on or below grade. 110.3(B) requires listed and labeled equipment to be installed per the manufacturer's installation instructions, there is currently no EMT fittings listed for direct burial. Table 300.5 identifies minimum cover for buried wiring methods, this table does not identify depth requirements for EMT.

NEC-9-04 (AZ Only)

Revision to NEC Article 501.16 (B)

501.16 (B) Types of Equipment Grounding Conductors.
(Article remains the same, delete exception):

~~Exception: In class I, Division 2 locations, the bonding jumper shall be permitted to be deleted where all the following conditions are met.~~
~~(a) Listed liquidtight flexible metal conduit 1.8 m (6 ft) or less in length, with fittings listed for grounding, is used.~~
~~(b) Overcurrent protection in the circuit is limited to 10 amperes or less.~~
~~(c) The load is not a power utilization load.~~

Reason: For coordination with Amendment to NEC Article 250.118

NEC-10-04 (AZ Only)

Revision to NEC Article 502.16

502.16 (B) Types of Equipment Grounding Conductors.
(Article remains the same, delete exception):

~~Exception: In class II, Division 2 locations, the bonding jumper shall be permitted to be deleted where all the following conditions are met.~~
~~(a) Listed liquidtight flexible metal conduit 1.8 m (6 ft) or less in length, with fittings listed for grounding, is used.~~
~~(b) Overcurrent protection in the circuit is limited to 10 amperes or less.~~
~~(c) The load is not a power utilization load.~~

Reason: For coordination with Amendment to NEC Article 250.118

NEC-11-04 (AZ Only)

Revision to NEC Article 503.16 (B)

503.16 (B) Types of Equipment Grounding Conductors.
(Article remains the same, delete exception):

~~Exception: In class III, Division 1 and 2 locations, the bonding jumper shall be permitted to be deleted where all the following conditions are met.~~
~~(a) Listed liquidtight flexible metal conduit 1.8 m (6 ft) or less in length, with fittings listed for grounding, is used.~~
~~(b) Overcurrent protection in the circuit is limited to 10 amperes or less.~~
~~(c) The load is not a power utilization load.~~

Reason: For coordination with Amendment to NEC Article 250.118

NEC-12-04 (AZ Only)

Revision to IRC Table E3503.1

Revise Table as Follows (Minimum Grounding Electrode Conductor Size to remain the same)

CONDUCTOR TYPES AND SIZES-THHW,THW,THWN,USE,XHHW (Parallel sets of 1/0 and larger conductors are permitted in either a single raceway or in separate raceways)		~~Allowable~~ ~~Ampacity~~	Service or Feeder Rating (Amperes)	
Copper (AWG)	Aluminum and copper-clad aluminum (AWG)	~~Maximum Load (Amps)~~	≤30°C (86°F)	> 30°c (86°f)
4	2	~~100~~	100	
3	1	~~110~~	110	
2	1/0	~~125~~	125	100
1	2/0	~~150~~	150	125
1/0	3/0	~~175~~	175	150
2/0	4/0 or two sets of 1/0	~~200~~	200	175
3/0	250 kcmil or two sets of 2/0	~~225~~	225	200
4/0 or two sets of 1/0	300kcmil or two sets of 3/0	~~250~~	250	225
250 kcmil or two sets of 2/0	350 kcmil or two sets of 4/0	~~300~~	300	250
350 kcmil or two sets of 3/0	500 or two sets of 250 kcmil	~~350~~	350	300
400 kcmil or two sets of 4/0	600 or two sets of 300 kcmil	~~400~~	400	350
500 kcmil	750 kcmil			400

Reason: Coordination with Amendment to NEC table 310.15 (b)(6).